

# FERTILIZERS FOR FRUIT GROWERS

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.... By ....

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**Director N. J. Agricultural Experiment Station**

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This is a day of new things. We are not satisfied that we are making proper progress, unless we have some new fad or fancy to occupy our attention ; some specific which will cure all ills. I am afraid, therefore, that I shall disappoint those who are expecting some new revelations in reference to fertilizers for fruits. My experience and observations teach me that while we are following the new we sometimes neglect the old and tried to our disadvantage. I, therefore, wish in the beginning to disabuse your minds of the hope of hearing of some startling discovery, for I am going to confine myself very largely to emphasizing the facts and principles that have been tried and established.

In the first place, I feel that fruit growers, like dairymen, should be classified into groups, in order that we may not be misled in believing that all persons who grow fruit are fruit growers in the best sense, and thus capable of using the information given in a way that would be helpful.

In the first group I would include those who make fruit growing their primary business, who before beginning their work study the question of soils, of drainage, of varieties, of methods of planting and handling orchards, and of markets, in order that they may know, or may have full knowledge of the best things, and when they have started their orchards they take pains to get as much up-to-date information as possible concerning insects and diseases, and their methods of treatment. They know that knowledge of principles and of best methods of practice pays, and they feel that without using their best intelligence in the various processes that fruit growing, like any other line of business, cannot be made the success that present conditions warrant. Their time and energies are devoted exclusively to fruit growing in its various phases. It occupies the first place in their thought and work. All

other lines of work are subsidiary, and are made to contribute to their success and profit as fruit growers. The members of this group are not a great number, though I think we have as large a proportion of them in this State as in any other. They are a progressive and, as a rule, a successful body of men. Their work is, or should be, an incentive and an inspiration, particularly to young men who are about to engage in their life-work.

In the second group are included those who, while in many cases successful, do not give their whole time to the growing of fruit. They are not so sure of their ground as those in the first group. They have not the courage of their convictions, and are thus unwilling to devote their whole time to this one branch of farming. Hence they have several lines going at the same time; their interests are divided, and because they do not know which line is going to be the best in any one year, all are neglected to some extent. For example, they may find that at the time their orchards ought to be cultivated, other crops ought to be put in—if both are not done at the right time, one or the other suffers. In such a case, no one line can receive the best attention at the time it should be given. Besides, with several lines the time for study that is necessary to enable the grower to perfect himself in the best methods of practice, is not sufficient to cover all. Therefore, no one subject is thoroughly mastered. I do not wish to be understood, however, as saying that it is not possible, and perhaps in a large number of instances quite as profitable for a man to divide his energies, inasmuch as in many instances his location or character of soil does not make it possible for him to utilize all of his land for fruit growing.

The main point which I desire to impress is, that because of the attention that must nowadays be given to make a success in fruit growing, the grower cannot afford to attempt too many things. It is, after all, knowledge of what and how to do that measures his success.

There is a third group, who grow fruit, and are often-times classified as fruit growers, because their product gets into the market, who have no intelligent understanding of the business, but whose products have a wide influence in determining the returns that shall be received for the product of others. I refer to the large number who have a few trees of apples or pears, or who set an orchard of peaches, because some one season prices have been high, with the hope that

somehow or other he will get a paying crop. There is no set purpose to make themselves familiar with the business. These growers do not know very much about varieties, they know less about handling their trees, and still less about insects and diseases, and their product is very often, though not always, poor, and it goes into the market ungraded, and in seasons of plenty helps to depress the value of the product of the good growers. There is no good reason why the fruit grown in this way should not be taken care of quite as well as that grown by those possessing larger areas, and thus contribute to the uplift of the industry rather than to help to depress it. It is for these reasons a difficult matter to give suggestions that will be useful or can be made practicable for all. The best that one can do is to define as clearly as may be the underlying principles which are involved in the growing of different classes of fruits.

I must admit that we have a great mass of undigested knowledge in reference to the whole matter, and that one great difficulty is that so many of us have such an incomplete knowledge of any specific portion of it. The controversies that are so frequent in our agricultural and horticultural papers in reference to soils, manures, cultivation, varieties, etc., are as a rule due to the fact that we see but one side of the question, or in many instances but one part of a side of the whole question. Statements are true on both sides, but because we do not know or cannot get the point of view of the other fellow, unfruitful discussions are indulged in and result in nothing.

Take the question of soils, and we find that these vary so widely in their characteristics as to make it possible to grow the very best kinds of fruit on one and the very poorest on another, with exactly the same treatment as far as cultivation, fertilization, manuring, trimming, and other factors are concerned. The same is true largely in the matter of manuring or fertilizing. Conditions are so variable that what one grower would regard as a manure might be of no service whatever to another. It is, therefore, a question of incomplete understanding of all of the principles that are involved.

Take the question of manures, and how often do we hear that this one followed a certain line of practice and it resulted in the production of the very best yield and quality of fruit. Another, using identically the same, reports that the results obtained are of no value. The reason for this is because conditions differ and their understanding of how to apply the principle, very defective.



It is my judgment that, aside from special instances and special crops, the whole manure question rests chiefly upon minerals and water. You say, what has water to do with manuring orchards? Why should it be regarded at all in connection with the subject of manures? I answer, in a broad sense, that anything that will contribute to the production of a crop, or makes it better than it otherwise would be, is a manure. The original meaning of the term "manure" has reference to the working of the soil, and from that we get the adage, "tillage is manure." Now, tillage in its best sense means making available dormant plant-food and the conserving of moisture, not the killing of weeds; the best tillage, therefore, will result in the best natural manuring.

It is manifest, however, that this cannot apply equally everywhere, on all kinds of soil, or in all locations, but it has its bearing, and a very important one, upon the question of the best production. One of the earliest investigators of the subject of manures believed that tillage was manure, because tillage resulted in making the particles of soil so fine that the roots of plants could absorb them directly. His conclusion was wrong, in the sense that he believed that the plants absorbed the particles, but it was right in the sense that he believed that extra tillage resulted in an increase in crop. Tillage was manure, not because it resulted in enabling the plants to absorb directly the finer particles of soil, but because it made them so fine as to enable the plants to readily dissolve them, and the better tillage enabled the soil to hold a larger proportion of water. When, therefore, I say that I believe minerals and water are the substances of greatest importance to fruit growers, I have reference to those soils which possess in their original character an abundance of the minerals which are essential for the growth of all crops, namely, phosphorus, potassium and lime, but do not wish to have it understood that in any case is it unnecessary that nitrogen should be a component part of manures.

In the next place, an indefinite knowledge of the functions of manures results oftentimes in reducing ultimately the productivity of soils. That is, reducing their fertility beyond the degree to which they would naturally be depleted. In these days of the concentration of energies, we must understand all of the phases of the question, if we are to make genuine progress.

Nine farmers out of ten, even to-day, will tell you that

they would prefer yard manure to any other kind, and yet probably not eight out of the nine could tell you the reason why it is so useful a product. They do not know that in addition to its contributing directly to the content of essential plant food elements in the soil that indirectly it improves its physical character, makes it more absorbent of moisture, and contributes to the development of organisms which are so active in converting both nitrogen and minerals into active forms. It is a general form, and, therefore, its use without specific knowledge as to its functions results favorably in the case of most farm crops, and may result in injury rather than in benefit when applied to specific crops upon specific kinds of soil. That is, while yard manure is one of the most generally useful of manures, because it is a manure in its broadest sense, and its continuous use in proper quantities will result in keeping up the soil to its full natural capacity, greater care is required in its use in orchards than any other one kind of manure. It must be used in conjunction with other amendments, and with direct plant-food in other forms, if we are to give to the fruits the kind and quality of food they need, and have them available at the time that the plant requires them and in the greatest amounts.

This may be true also in many instances of fertilizers or manures for other crops, yet it should be emphasized more fully in the matter of fruits, because they differ not only in their habits of growth, but in the character and composition of the crops themselves. For example, general farm crops, with few exceptions, require but one year for the entire processes of vegetation and of ripening. Fruit crops, on the other hand, as a rule require a preparatory period of growth before the crop is produced, and this period is longer or shorter, according to the kind of fruit.

In the next place, the character of fruit differs from that of general farm crops, because after the period of fruit bearing begins the vegetative forces do not cease, but go on while the growth and ripening of the fruit is in progress. The crop itself also differs materially in its character from vegetables or other farm crops, which reach their maturity in one season, because for many kinds nearly a whole season is required for the growth and development of the fruit itself. Fruit growing also differs from other lines of farming in the sense that it is really a continuous cropping of the same kind, and no opportunity is afforded to correct the tendency to exhaust the

soil by frequent change of crops, which may require different kinds and amounts of plant-food constituents. These are the essential points of difference between farm crops and fruit crops, and because of these marked differences, character of soil becomes an important consideration. Sometimes I think that fruit growers are guided in their methods of management of their orchards by nature's management of forests; they see the forests start and grow without any particular attention, and argue, if not in so many words, by their actions, that the same treatment ought to work in fruit growing. Their trees are planted, and then they are left to nature's care, uncultivated, unmanured and untrimmed, and they become yellow and knotty and thoroughly unthrifty. They do not seem to realize that an orchard for fruit growing is an artificial, and not a natural, crop, and cannot survive under natural conditions any more than can wheat or corn. It is not according to the general laws of nature that fruit should grow and produce abundantly without special care and management. They observe, too, in many instances, that fruit trees grow, develop and produce good fruits without a great deal of fertilizing or manuring upon some soils, and argue that what is true of one orchard should be true of another, and hence there is a very wide difference in the results obtained from orchards planted on different kinds of soil. Naturally good soils, that is, soils well supplied with the minerals of the right sort, as those derived from limestone, granite or trap, or mixtures of one or more, will produce large, vigorous trees, and produce good fruit without a great deal of care, provided they are so located as to have good natural drainage, and at the same time to have moisture within reasonable distance of the surface. The almost perfect natural conditions, however, do not prevail largely throughout this or any other State, though full advantage is not taken of all such locations. For certain kinds of fruit, however, soils which originally are very poor may be made excellent for the growth of fruits.

In other words, the original soil is a very important contributing factor, and it does not follow that crops grown well on one will grow well on another. This, of course, is not important, except as leading up to the question of cultivation, manuring and fertilization, because all of these are more important in one case than in the other. Given a good soil, or one which possesses the valuable characteristics mentioned, and you will readily see that while fruit trees cannot grow



and bear abundantly without nitrogen, the chief consideration is minerals and water ; minerals to supply those necessary to form the basis of acids which exist in the fruits themselves, as well as to support and strengthen the fibre of the roots, stems and branches, while nitrogen, because not required in so large amounts, and because in many cases it can be obtained indirectly ; and because, in the third place, if existing in too large amounts and in too readily available forms, may contribute to the undue development of leaf and branch, is not so important from the standpoint of actual supplies of plant-food. I do not wish to be understood as saying, however, that nitrogen is not an important factor in many instances, but when the relation of tree to soil is considered, it is rather the mineral than the organic supplies of food that must be most carefully considered. Neither does it follow that the fertilization or manuring, or treatment of any sort, which is the best for apples or pears must necessarily be the best for peaches, or plums, or cherries, or for strawberries, or gooseberries, or blackberries. All of these various kinds of fruit possess different characteristics, which renders it necessary that they should have a different habitat, and that the results of artificial treatments should be variable. It is manifestly impossible, too, to include all berry and fruit crops in one general group, though possessing many points of resemblance. The different ones varying more or less in their character ; trees of certain fruits are long-lived ; others are short-lived. In some of them the cropping period is short—the fruit ripens early and at once, while in others the ripening period extends through a considerable period. While similar recommendations may be made in many cases, it is desirable that each class should be considered separately, and that distinctions should be made between what may be regarded as good soils, medium soils and poor soils, in respect to their content of plant-food. Those forms of plant-food which decay and give up their constituents slowly are perhaps quite as good, if not better, for many kinds of fruit than those which by their solubility and availability are more stimulating in their character. Those fertilizers which do not contribute to the immediate feeding of the tree or plant, but which add to the reserves of potential plant food should, however, in many cases be supplemented by those which act more quickly, in order to supply an abundance of available food at special times and seasons. I believe, therefore, that a basic formula, the chief claim of which is that it

furnishes large amounts rather than special proportions or forms of plant-food, may be more reasonably adopted for fruits and berries than for other crops. It may be applied with advantage to all of the fruits, and the specific kinds which have a special influence upon quality, or size, or earliness, may be adjusted in their application to meet the requirements of the different kinds of fruit on the different kinds of soil.

A careful study of such experiments as have been conducted with fruits here and elsewhere leads me to believe that a formula made up of one-third, by weight, of ground bone, acid phosphate and muriate of potash would serve an excellent purpose as a basic formula for the preparatory treatment of all kinds of soils for all kinds of fruit. There are several reasons for this. The first is because such a mixture could do no harm in any case; second, it adds direct plant-food to the soil, and of the kind liable to be needed in all cases; third, the constituent elements are not so quickly available as to cause an undue stimulation of tree, on any kind of soil; besides, inasmuch as it is a formula which supplies chiefly of the minerals, there is practically no danger of any loss of plant-food from the soil; fourth, since it is quantity rather than quality which we are considering, the amounts applied can be readily adjusted to meet what is believed to be the deficiencies of the various classes of soils. This formula meets in a superlative degree the requirements of such long-lived fruits as apples and pears, and may contribute to the vigor and longer life of peaches, plums, berries and other small fruits.

The next question is, when and how much of a basic formula of this sort should be applied per acre. A mixture of this kind, derived from materials of average composition, would contain approximately :

Nitrogen . . . . .	1 per cent.
Phosphoric acid . . . .	12 “
Potash . . . . .	16 “

An annual application of 1000 pounds per acre in the early life of the orchard, and 500 pounds per acre later, would not be excessive, as we must provide for a large annual growth of wood, leaves and fruit, for a long period, and when it is remembered that in an established orchard it is not easy, after it has arrived at the age of fruiting, to get the right kind of fertilizing material into the soil, where it is most needed, the

heavier applications should be made at least during the first five or six years of the growth of the orchard, when it is possible to successfully work the fertilizers into the soil. This may not all be needed then, but will ensure sufficient amounts of the mineral elements to supply all the needs of the crop for many years. Hence, even on good soils care should be taken to abundantly supply the soil with the mineral food, and its application should be such as to enable it to become thoroughly incorporated with the surface layer of soil. Whether the orchard shall be cultivated after it has reached its fruiting stage or not depends, in my judgment, very largely upon whether there is a sufficient abundance of mineral food in that soil for all the needs of the trees after they have arrived at the bearing stage. Cultivation of good soil does make plant-food available, if it originally exists in the soil. Cultivation afterward, upon soils well supplied with the minerals, is not so important from the standpoint of supplying available food, as it is from the standpoint of holding in the soil the water that enables the root to perform its function in acquiring its food. Hence, the question of whether the soil shall be mulched, or whether it shall be left in sod, hinges practically upon the question of the original food in the soil, and the treatment given it to prevent the escape of moisture.

The important question next, then, is since this basic formula is to supply the minerals only, phosphoric acid and potash, together with an occasional application of lime, whether there should be some nitrogen applied, particularly for apples and pears. For these crops, I believe that the mixture would contain a sufficient proportion of nitrogen upon good soils, well supplied with humus. On light soils, the necessity that the fertilizers shall contain a liberal supply of nitrogen is greater, and is frequently very apparent, in which case it may be applied in organic forms when the land is cultivated, and preferably from those materials which do not decay too rapidly because this will furnish the nitrogen quite as rapidly as it is needed by the tree. In many cases, too, it is possible to obtain the necessary nitrogen from the growing of leguminous crops, as crimson clover, cow peas, soy beans, vetches, etc., though when these are used great care should be exercised in their handling, in order that their growth may not interfere with the growth of the tree.

Always keep in mind that any crop grown in the orchard after the first year or two is grown not for the crop itself, but

because it contributes to the growth of the tree and the ultimate accomplishment of the purpose—fruit. If cover crops are allowed to remain in the orchard until they mature, they not only absorb food that may be necessary for the growth of the tree and fruit, but the moisture also, and thus frequently injure rather than improve the crop prospects. However, the application of the basic fertilizer should continue in the orchard, and how much of the special formulas should be used later must be determined by the grower himself. The food applied must be in their more soluble forms, as, for example, nitrates, superphosphates and soluble potash salts, and they should be applied in not too large quantities, and preferably especially the nitrate, early in spring, in order that they may be utilized early, and thus not contribute to late growth, which interferes with the maturity of fruit.

No definite rules can be laid down as to amounts to be applied, and no suggestion other than the above, namely, that the moment a tree is hungry that moment food should be supplied; and the evidences of hunger are so apparent in nearly all orchards that I believe that four times as much fertilizer as is now used could be applied with very great profit. For we must remember that not only is the fertilizer necessary, in order to feed the plant, but that when we supply these needs we contribute to the power of that tree to resist insect and fungous attacks, to outgrow slight injuries, which would result in the absence of full nourishment in very materially injuring the fruit prospects.

I do not wish to be understood as saying that a liberal fertilization of an orchard will prevent disease, parasites and injuries of that nature, but that their effect is not so apparent as when abundant food is supplied. Old orchards that have been partially neglected, fertilized with the basic formula, with judicious trimming and cultivation may bring back, in large part, at least, the vigor and health of the tree. The trouble in most of these cases has been that the growers are either indifferent or ignorant. Their trees have not been fed and therefore have been unable to resist insect and disease attacks, changes in weather, or untoward conditions, and thus have not the power to assimilate and use the plant-food that would be possible where best conditions prevail.

The suggestions thus far have their application more particularly to apples and pears, fruits that bear for a long time. In the case of peaches, upon good soils, the necessity for fer-



tilization is seldom apparent until after the first or second year of growth. On medium and poor soils, the setting of the trees should be preceded by the application of the basic fertilizer referred to at the rate of 600 to 800 lbs. per acre, and should be followed by the application of the more soluble fertilizers immediately the trees begin to bear. The need of nitrogen is often very marked, and is shown by the lack of vigor of tree, and soluble nitrates have proved very valuable as a source of this element, since from these the nitrogen may be appropriated by the roots during the early season, and which, if a sufficient abundance of the minerals is present, enables a normal development of fruit. This fertilizer should be applied early in the season, in order that the food may be appropriated early, and thus prevent an undue development of leaf and branch, and thus not permitting the ripening of the wood before the beginning of the winter. Thus, on poor soils, 100 to 150 lbs. nitrate of soda, 200 of acid phosphate, and 100 of muriate of potash per acre should be applied early in the season, and carefully worked into the soil, in addition to the amount of the basic formula referred to. In all cases the land should be cultivated, which will thoroughly distribute the fertilizers in the soil.

These suggestions apply, also, in the case of plums and cherries, though for the latter more frequent liming is desirable.

For small fruits in general the same considerations as to the needs for liberal fertilization apply, yet because of their different character of growth, the method of fertilization should be somewhat different. They require a shorter preparatory season, and have a shorter period of bearing life. In respect to their general character they correspond more nearly with the vegetable crops than with the cereal grains, in that they possess a relatively higher market value and a lower fertility value than these, and the period of growth and development of the fruit is much shorter. For these reasons, natural sources of plant-food may be largely ignored in their growth, and the more quickly available (particularly nitrogenous and phosphatic) materials supplied.

In the case of the strawberry, the preparatory period of growth of the plant before bearing is but one year, and the crop that may be obtained is largely dependent upon the strength and vigor of plant which has been acquired during this period. Hence it is desirable that the soil in which the



plants are set should be abundantly provided with the mineral elements, particularly with soluble and available phosphoric acid. Hence an application of the basic formula should be made previous to setting the plants and well worked into the soil. The applications afterward should contain quickly available plant-food, especially of nitrogen, and should be applied early in the season, say a mixture of 100 to 150 lbs. of nitrate of soda, 200 to 300 lbs. acid phosphate and 100 to 150 lbs. sulphate of potash. These same general considerations apply to the other berries usually grown.

In all of these suggestions as to artificial fertilization it must be understood that soils should be supplied as abundantly as is possible with decaying vegetable matter, because this humus-forming material contributes both to the improvement of the physical character of soil and the requirements for food, as well as to the conservation and better distribution of water, the one thing more than any other which controls size and quality of crop. Whether this shall be accomplished by the infrequent use of yard manure, or the judicious cropping with leguminous plants, is largely a matter of conditions. In the first case, it must be remembered that large applications of organic materials to orchards may result in an uneven development of tree and fruit. Whereas, if cover-cropping is practiced, and legumes and other plants grown to supply the vegetable matter, it must not be forgotten that the use of these crops is for the purpose of feeding the tree, and not for the crops themselves, and therefore they should be used with the greatest care. Much injury may be done by the use of cover crops, if they are not either cultivated into the soil or plowed down at just the right time, and it is my observation, especially in peach orchards, that it is better that crimson clover, especially, be cultivated into the soil in Spring as early as it would otherwise be cultivated, the benefits being derived from the covering of the crops during the winter, and such organic matter as has been gathered up to the time the land is cultivated. I mention these only insofar as they have a bearing upon the question of fertilizers, and do not give any specific directions for their use. As I stated in the beginning, the sum and substance of fertilizing orchards is very largely a question of supplying an abundance of the minerals, phosphoric acid and potash, and in providing for a sufficiency of water.

The President—The doctor knows what he is talking about, but the last lecture I heard him give cost me seven or eight hundred dollars. It changed my theories on some things entirely, but he convinced me he was right.

Mr. Collins—I want to ask the doctor a question: I think the doctor mentioned ground bone as one of the constituents?

Dr. Voorhees—Yes.

Mr. Collins—Why do you recommend bone instead of ground phosphate rock; is it better?

Dr. Voorhees—Not necessarily; in some you may find that you will get your phosphate quickly, but in the long run bone is more active and is preferable. If you put on ground phosphate, and put a large quantity on, and have abundance of organic matter in the soil, it will probably give you good returns. It is a question of conditions. If you can buy ground phosphate at a low enough price to enable you to get some return immediately, or where you had used leguminous crops or manure, you can put on your ground phosphate, provided you get it cheaper, but you can't get it cheap enough as a rule.

Mr. Collins—Another thing: I know one of the best fruit growers in New Jersey cares nothing about the humus in his orchard.

Dr. Voorhees—I don't care anything about it either, as long as I can get the moisture.

Mr. Collins—The ground is dry.

Dr. Voorhees—The plants get the moisture; there must be some source within reach of the trees, as water is one of the first essentials.

Mr. Collins—From the quality of the fruit he raises it don't look as if he got any. I can't reconcile it.

Mr. Beebe—In cultivating an orchard the root growth is partially destroyed; are the benefits derived sufficient to balance this injury.

Dr. Voorhees—That depends upon the kind of tree and the kind of soil, and the method of fertilization. If you put the fertilizer on top, and you haven't any food below the surface, that plant will go up there and get it.

Mr. Beebe—How are you going to get it in below?

Dr. Voorhees—Plow it in; if you are going to grow an orchard on poor soil, plow it in.

Mr. Beebe—Before the orchard is set you can do that, but after thirty years?

Dr. Voorhees—You have got to do it early and get it in then.

Mr. Beebe—I am thinking more of the old orchard.

Dr. Voorhees—That is the real reason why I recommend a large application, because in your old orchard you cannot get it into the soil so readily, unless you do cultivate. You can put your nitrate or phosphate on, but unless your soil is of such a character as to enable it to get down in, it is all on the surface and not where the roots are ordinarily located.

Mr. Beebe—The point I make is, that if you put it in you might kill so many roots, and I wonder whether it is worth while.

Dr. Voorhees—Then I would not do it if that is your opinion.

Mr. Beebe—On my father's farm he plowed his orchard and had to go and buy his apples from a man who didn't plow.

Dr. Voorhees—This whole question of fertilizing successfully is largely dependent upon the subsequent cultivation.

A Member—Will soluble potash leak out of the soil.

Dr. Voorhees—No; but you apply potash on the surface of soil which contains a good deal of fine silt or clay, and it is fixed right there. When you apply a large quantity on soil like that you ought to harrow it.

A Member—Insoluble potash would be the same way.

Dr. Voorhees—Yes, it would stay just where you put it. But the potash salt is soluble, and on some soils it will distribute itself much better than on soils that have an abundance of fine particles of clay. Then the tendency is to distribute only enough to fix that, and then stay there. It is a good deal like soluble phosphate, that will reach out in sandy soil, but these unfavorable conditions are very seldom met with.

Mr. Repp—Is it profitable to put lime in an orchard?

Dr. Voorhees—Yes, for some kind of soil, because plants require it. I have seen orchards which suffered from lack of lime. The vigor of the trees was of such a character to indicate that.

A Member—What kind of lime do you recommend?

Dr. Voorhees—Carbonate of lime.

A Member—How about gas lime?

Dr. Voorhees—That would be all right.

A Member—How much per acre would you put of gas lime?

Dr. Voorhees—I should put about 20 to 25 bushels of good lime and about 40 bushels gas lime, although for some plants direct application of gas lime would have a tendency to injure the young plants.

A Member—How often would you apply it?

Dr. Voorhees—Once in five or six years.

Albert Repp—I know a man that has not had lime on his farm for years. He covered his whole farm with gas lime last year; this year he got about 80 loads of hay where he had never gotten but very little before.

Dr. Voorhees—Gas lime does not possess any quality that will help the plants in a greater degree than ordinary lime.

Mr. Fullerton—I didn't quite get your basis of proportion of fertilizer mixture.

Dr. Voorhees—About one-third of each.

A Member—Provided you have organic matter, what ratio would you think would warrant you in buying floats.

Dr. Voorhees—We find that ground bone averages from one-third to one-half available the first year, and the balance would take possibly four to five years, depending on soil and crop conditions. Now in the ground floats the proportion you get would be very much less the first year. The whole question would have to be worked out in the first place as to the availability of it under average conditions. I should think I would want to buy my float at about one-third the cost of phosphoric acid that I buy it in the animal bone phosphate, and if I didn't have any organic matter I should not consider it at that price.

Mr. Fort—I had a neighbor who was using gas lime on his farm, and he wanted to make his grass grow, and he went in with the gas lime and gave it a liberal coat of lime. The fact was that the gas in this lime stripped the leaves off of his trees so that the blackbirds had no cover. The trees were stripped of foliage until that gas passed off, and then nature covered them again.

Dr. Voorhees—I don't think it would take the leaves off an apple tree, but it is always better to have your gas lime exposed for a year or so before using it. The fresh gas lime does contain a volatile substance which has been found to be injurious. You will find it injurious when you apply it to young growing crops.

Mr. Fort—I put fresh gas lime on some field and planted corn and it didn't come up.

Dr. Voorhees—You would not have had that trouble had you exposed it to the air for a year. The only trouble so far as the action of the lime is concerned, it is not in as fine a condition. It has gone back to the carbonate form in part. It has been changed. It has been wet and it is not so caustic. There is a whole lot to this lime question and a whole lot that we don't know, but there is a whole lot we do know and which would help us a great deal in planting our orchards. I believe that lots of orchards are suffering for lack of lime.

Mr. Repp—Your opinion is to use caustic lime on new ground and carbonate of lime for old ground?

Dr. Voorhees—Yes, that would answer.







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